EC202C1 – Intermediate Macroeconomic Analysis
Spring 2012, Boston University

Instructor: Jeremy Smith

First Mid-term Exam (Practice #1)

Thursday, February 23, 2012

This is a 50-minute exam. There is a total of 50 points allocated across two questions. Use the number of points allocated to each part as a suggestion for how long to spend on that part. I recommend that you attempt all parts before using more time than is suggested for any one part. If you complete some parts in less than the suggested time, use your extra time to revisit parts you may have had trouble with the first time through and to check your work.

Please read the questions carefully and write your answers in the space provided. You can use the backs of the sheets for scrap paper, but to get full credit you must show all relevant work in the space provided.

Please follow my instructions at all times.

Concentrate and think carefully, but try to relax too!

Student Number: Solutions

(Please do not include your name.)

1. [32 points total, 4 parts] Consider the following behavioral equations and exogenous variables describing the economy:

$C = 200 + 0.3Y_D$
$I = 300 + 0.2Y - 3000i$
$(M/P)^d = 2Y - 8000i$

$G = 360$
$T = 200$
$(M/P)^s = 2000.$

a) [11 points] Derive the *IS* relation. Derive the *LM* relation. Find the short-run equilibrium output level and interest rate.

answer:

goods market

$Y = Z$
$Y = C + I + G$
$Y = (200 + 0.3(Y - 200)) + (300 + 0.2Y - 3000i) + 360$
$Y - 0.3Y - 0.2Y = 200 - 0.3(200) + 300 - 3000i + 360$
$0.5Y = 800 - 3000i$
$Y = 1600 - 6000i$ (*IS* curve)

financial market

$(M/P)^s = (M/P)^d$
$2000 = 2Y - 8000i$
$8000i = 2Y - 2000$
$i = Y/4000 - 1/4$ (*LM* curve)

equilibrium

Substitute *LM* into *IS*:

$Y = 1600 - 6000(Y/4000 - 1/4)$
$Y + 1.5Y = 1600 + 1500$
$2.5Y = 3100$
$Y^* = 3100/2.5 = 1240.$

Substitute Y^* into *LM*:

$i=(1240)/4000 - 1/4$
$i^* = 0.31 - 0.25 = 0.06 = 6\%.$

b) [7 points] Now suppose that the government decides to reduce the budget deficit. Specifically, government spending decreases to $G = 340$ and taxes increase to $T = 300$. Calculate the new short-run equilibrium output level and interest rate.

answer:

Derive the *IS* curve again with the new level of government spending and taxes:

$Y = (200 + 0.3(Y - 300)) + (300 + 0.2Y - 3000i) + 340$
$0.5Y = 750 - 3000i$
$Y = 1500 - 6000i$ (new *IS* curve).

Now solve for the new equilibrium by substituting the unchanged *LM* into the new *IS*:

$Y = 1500 - 6000(Y/4000 - 1/4)$
$2.5Y = 3000$
$Y^{**} = 3000/2.5 = 1200$

and

$i = (1200)/4000 - 1/4$
$i^{**} = 0.3 - 0.25 = 0.05 = 5\%$.

(It could also be acceptable to calculate the new equilibrium by using the multiplier, though this would have required the memorization of the general expression for the multiplier and its correct calculation from the behavioral equations. The multiplier should come out to 0.8 in this case, so that the reduction in government expenditure will decrease output by 0.8*20=16. The increase in taxes reduces output by the marginal propensity to consume times the change in taxes times the multiplier, or 0.8*0.3*100=24. The overall reduction is thus 16+24=40, for equilibrium output of 1240-40=1200, as above. As I've said before, I don't recommend this for exams, though it can be a useful check when practicing. Note that attempting to answer the previous part using memorized formulas – for example, a general expression of Y^* – would be unacceptable and would earn very little partial credit.)

c) [5 points] Consider a hypothetical alternative policy in which the government had kept spending constant relative to part a) at 360 and raised taxes to 320. As with the actual policy of part b), the budget deficit would be 40 with this hypothetical alternative policy. Would equilibrium output also be the same under this hypothetical alternative policy compared to the actual policy in part b)? Explain your answer briefly and without doing further calculations.

answer:

The equilibrium output level would not be the same under the hypothetical alternative policy. This is because taxes and government spending do not affect the aggregate demand for goods symmetrically. Spending affects demand directly, but taxes only affect demand indirectly through disposable income and hence consumption. Because the marginal propensity to consume is generally less than one, the effect of a tax increase on output is less than the effect of a cut in government expenditure of the same size. So equilibrium output would be slightly higher under the hypothetical alternative policy compared to the actual policy. (The policy would of course still be contractionary on net, though, i.e. equilibrium output would still be less than in part a).)

d) [9 points] Now suppose that, with the actual policy of part b) in place ($G = 340$ and $T = 300$), the central bank decides that it would like the interest rate to be 8%.

i. Find the level at which the central bank will have to set the real money supply in order to meet this interest rate target.

ii. With both this monetary policy and the fiscal policy of part b) in place, how would you expect the level of consumption to compare to that in the original short-run equilibrium of part a)? Explain why in words, without calculating the consumption levels.

answer:

i. To increase the interest rate (8% is higher than the 5% that was found in part b)), the monetary authority needs to reduce the real money supply. In other words, there will need to be contractionary monetary policy. Precisely how low will the real money supply need to be set to hit the interest rate target exactly? There's a long way to find this and a shorter way. The long way would be to go through the whole derivation of the *IS* and *LM* curves again while treating M/P as an arbitrary variable, then solve for equilibrium output and the interest rate in terms of this variable, then finally set the equilibrium interest rate to 8% and solve for the required real money supply. The shorter way is to note that the *IS* curve is not affected by monetary policy, so that when the money supply cut shifts the *LM* curve up, there will be a movement along the new *IS* curve we found in the previous part as the new equilibrium is reached. (This is a great example of situation in which it pays to think graphically even though a graph isn't asked for.) If we want this equilibrium to be at an interest rate of 8%, this new *IS* curve tells us what the corresponding equilibrium output level must be. This output-interest rate pair can then be substituted into the real money demand function to give the corresponding equilibrium level of demand for real cash, which of course must equal the real money supply in equilibrium.

$Y = 1500 - 6000i$ (new *IS* curve from part b))
$= 1500 - 6000(0.08)$ (insert desired interest rate)
$= 1500 - 480$
$= 1020.$

$(M/P)^d = 2Y - 8000i$
$= 2(1020) - 8000(0.08)$
$= 2040 - 640$
$= 1400.$

Therefore, the real money supply must be reduced from 2000 to 1400 in order to achieve a new equilibrium in which the interest rate is 8%.

(It's not correct to substitute the 8% interest rate into the real money demand function and use an existing level of output, because this ignores how the goods market will respond as the interest rate starts to adjust following the monetary contraction.)

ii. Combining the contractionary fiscal policy of part b) with this contractionary monetary policy, consumption will definitely be lower compared to part a). This is because consumption increases with income (i.e. output) and decreases with taxes. Taxes have increased, which reduces disposable income and hence consumption, and indirectly output; and government expenditures and the money supply have both decreased, which push output down directly, as well as indirectly through the multiplier process. All of these factors serve to push consumption down, unambiguously. (For practice, you can put the respective values of output and taxes into the consumption function. You should get consumption of 512 in part a) and consumption of 416 when both policies are in place. Consumption is indeed lower in the latter case, confirming the general prediction we just reasoned our way to.)

2. [18 points total, 2 parts] Assume that the economy begins in recession, at a short run equilibrium output level below the natural level of output. The government responds with expansionary fiscal policy, but the resulting output level is still below the natural level of output. The central bank responds immediately thereafter with expansionary monetary policy, which results in an equilibrium output level above the natural level of output.

a) [10 points] Illustrate this situation in the *AS-AD* framework. On your graph, make sure to identify:

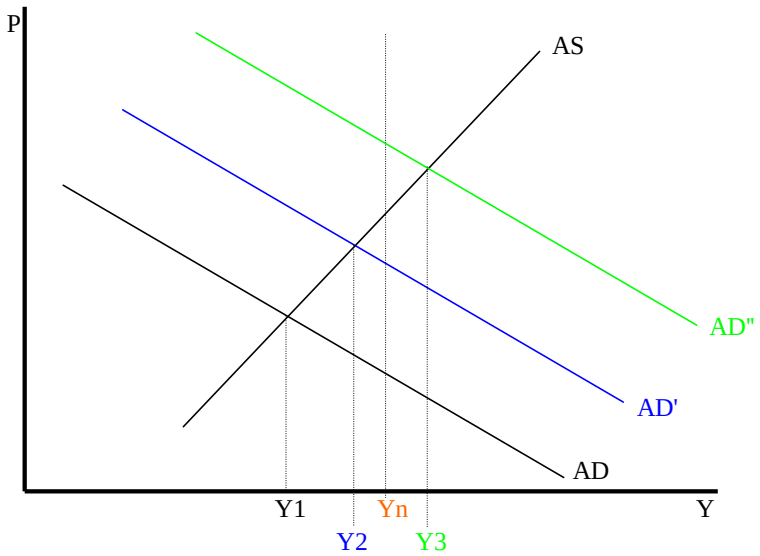
i. the economy's starting point;

ii. the natural level of output;

iii. the short run equilibrium (including labor market adjustment) that would arise if only the fiscal policy were put in place; and

iv. the short run equilibrium (including labor market adjustment) following the fiscal policy and the subsequent monetary policy.

answer:



The economy starts at Y_1, at the intersection of *AD* and *AS*. The fiscal expansion shifts aggregate demand to *AD'*, and if no other action were taken, the economy would be at a new short run equilibrium with output of Y_2 (which is lower than the natural rate of output, Y_n, as required). The subsequent monetary expansion shifts aggregate demand to *AD"*, and the economy to its new short run equilibrium with output of Y_3 (which is higher than the natural rate of output, Y_n, as required).

Note that the expected price level stays constant throughout the short run (at the height corresponding to the intersection of *AS* with Y_n, though identifying this was not asked for). Therefore, aggregate supply will stay fixed at *AS* as well. This bears repeating: price

expectations remain fixed in the short run; thus, in this part, which deals only with the short run, the *AS* curve does not shift. The phrase "including labor market adjustment" is a reminder that increasing output draws more workers into employment, thus raising nominal wages and hence the price level. So Y_2, for example, is the net result of a rightward shift in *IS* and a small upward shift in *LM* due to this higher price level. The evolution of price expectations of course involves further adjustments in the labor (and other) markets, but these play out over the medium run whereas, again, this part is dealing with the short run only.

b) [8 points] Now suppose that there are no further policy interventions or shocks, and that the economy converges to medium run equilibrium. State the direction in which each of the following variables changes, comparing their values in this medium run equilibrium to their values when the economy started in recession.

answer:

Output	increases
Actual Price Level	increases
Unemployment Rate	decreases
Actual Real Wage	stays the same
Nominal Wage	increases
Investment	ambiguous
Consumer Confidence	stays the same
Employment	increases

All that would be required for full credit for a question like this would be filling in the blanks as above, i.e. no explanations are necessary when they're not asked for. The following details are just so you can check your thinking.

In the absence of any other policies and starting from the last identified short run equilibrium at Y_3, price expectations are below the actual price level. Therefore, over the medium run, price expectations will adjust upwards and aggregate supply will hence shift up until, over time, it intersects AD'' at Y_n. Identifying this, either in words here or on the graph in the previous part, is not asked for or required. However, it is crucial to understand it to be able to state in which direction the variables above change. We want to compare the starting point at the intersection of *AD* and *AS* to the new medium run equilibrium where AS_x (not shown) intersects AD'' at Y_n.

Output clearly increases ($Y_n > Y_1$), and this implies by construction of the aggregate supply curve that employment increases and the unemployment rate decreases. The price level clearly increases (because the height of AD'' at Y_n is greater than the height of AD at Y_1).

The actual real wage is always $1/(1 + \mu)$, from the price-setting relation and our model of the labor market, so it's the same at the initial point, new medium run equilibrium and all points in between. The combination of a constant real wage and an increase in the price level means that the nominal wage must have increased as well (in fact, by the same proportion as the increase in the price level). This can also be seen by looking at the general form of the wage setting relation: the unemployment rate decreases and the expected price level increases (from the height corresponding to the intersection of AS with Y_n to the height of AD'' at Y_n), both of which serve to push up nominal wage demands.

I'll admit to being a bit tricky with the remaining two variables. A drop in consumer confidence may very well have triggered the recession we find ourselves in at the beginning of the problem, but no reference is made to it, so we must implicitly assume that it stays constant, as we usually do with this and all the other exogenous parameters of the model such as μ, z, b_2 and so on.

Investment could go either way (or even, if everything were just right, stay the same). The higher output would tend to increase investment, so if the interest rate were lower, we'd be able to say for sure that investment increases. Unfortunately, we don't know for sure what happens to the interest rate. The fiscal policy shock and the price increase would tend to push the interest rate up, while the expansion of the nominal money supply would tend to push it down. If the former effects dominate, the interest rate will increase. Even still, investment could increase on net if the sensitivity to the interest rate were small enough, but we just can't know with certainty. Looking at the condition for equilibrium in the goods market ($Y = C + I + G$) won't help us either, because all four pieces are moving.